

CLAIMS

What is claimed is:

- 1 1. An absorbent composition, comprising:
2 particles of an absorbent material; and
3 particles of activated alumina dry mixed with the particles of absorbent material,
4 the activated alumina being present in an amount of about 0.01% to about
5 50% by weight based on a total weight of the composition.

- 1 2. An absorbent composition as recited in claim 1, wherein the absorbent material is
2 selected from a group consisting of: a mineral, fly ash, absorbing pelletized
3 material, perlite, silica, organic materials, and mixtures thereof.

- 1 3. An absorbent composition as recited in claim 1, wherein the absorbent material is
2 a mineral selected from a group consisting of: bentonite, zeolite, montmorillonite,
3 diatomaceous earth, opaline silica, Georgia White clay, sepiolite, calcite,
4 dolomite, slate, pumice, tobermite, marls, attapulgite, kaolinite, halloysite,
5 smectite, vermiculite, hectorite, Fuller's earth, fossilized plant materials,
6 expanded perlite, gypsum, and mixtures thereof.

- 1 4. An absorbent composition as recited in claim 1, wherein the particles of absorbent
2 material have a particle size in a range from about 0.05 to about 10,000 microns.

- 1 5. An absorbent composition as recited in claim 1, further comprising a
2 performance-enhancing active selected from a group consisting of: an
3 antimicrobial, an odor reducing material, a binder, a fragrance, an animal health
4 indicating material, a color altering agent, a dust reducing agent, a nonstick
5 release agent, a superabsorbent material, cyclodextrin, zeolite, activated carbon, a

- 6 pH altering agent, a salt forming material, a transition metal salt, and mixtures
7 thereof.
- 1 6. An absorbent composition as recited in claim 1, further comprising a color
2 altering agent selected from a group consisting of dye, pigment, bleach, lightener,
3 non-staining coloring agent, embedded coloring agent, and mixtures thereof.
- 1 7. An absorbent composition as recited in claim 1, wherein the activated alumina is
2 present in an amount of about 0.1% to about 15% by weight based on a total
3 weight of the composition.
- 1 8. An absorbent composition as recited in claim 1, wherein the activated alumina is
2 present in an amount of about 15% to about 50% by weight based on a total
3 weight of the composition.
- 1 9. An absorbent composition as recited in claim 1, wherein the activated alumina is
2 present in an amount of less than about 5% by weight based on a total weight of
3 the composition.
- 1 10. An absorbent composition as recited in claim 1, wherein the particles of activated
2 alumina have a particle size in a range from about 0.05 to about 10,000 microns.
- 1 11. An absorbent composition as recited in claim 1, wherein the particles of activated
2 alumina have a particle size in a range from about 1,000 to about 2,000 microns.
- 1 12. An absorbent composition as recited in claim 1, wherein a particle size of the
2 activated alumina is selected based on a particle size and density of the absorbent
3 material such that segregation of the activated alumina in the composition is
4 minimized.

- 1 13. An absorbent composition as recited in claim 1, wherein colorant is added to the
2 particles of activated alumina.
- 1 14. An absorbent composition as recited in claim 1, wherein activated alumina is
2 coated onto the particles of absorbent material.
- 1 15. An absorbent composition as recited in claim 1, wherein particles of activated
2 alumina and absorbent material are combined in composite particles.
- 1 16. An absorbent composition as recited in claim 1, further comprising particles of a
2 material selected from a group consisting of zeolite and silica gel.
- 1 17. An absorbent composition as recited in claim 1, further comprising baking soda
2 for reducing sticking of the composition to a container upon wetting.
- 1 18. An absorbent composition as recited in claim 1, wherein the composition is
2 capable of clumping upon wetting.
- 1 19. An absorbent composition as recited in claim 1, wherein the composition is
2 flushable.
- 1 20. An absorbent composition as recited in claim 1, wherein the composition is
2 capable of clumping upon wetting and is flushable.
- 1 21. An animal litter with improved odor control, comprising:
2 0 to about 50% of at least one additive; and
3 up to 100% activated alumina by weight based on a total weight of the
4 composition..

- 1 22. An animal litter as recited in claim 21, further comprising water-swellable clay
2 particles capable of adhering to other such particles upon contact with moisture.
- 1 23. An animal litter as recited in claim 21, wherein the additive is selected from a
2 group consisting of: a mineral, fly ash, absorbing pelletized material, perlite,
3 silica, organic materials, and mixtures thereof.
- 1 24. An animal litter as recited in claim 21, wherein the additive is a mineral selected
2 from a group consisting of: bentonite, zeolite, montmorillonite, diatomaceous
3 earth, opaline silica, Georgia White clay, sepiolite, calcite, dolomite, slate,
4 pumice, tobermite, marls, attapulgite, kaolinite, halloysite, smectite, vermiculite,
5 hectorite, Fuller's earth, fossilized plant materials, expanded perlite, gypsum, and
6 mixtures thereof.
- 1 25. An animal litter as recited in claim 21, wherein the particles of additive have a
2 particle size distribution in a range from about 0.05 to about 10,000 microns.
- 1 26. An animal litter as recited in claim 21, further comprising a performance-
2 enhancing active selected from a group consisting of: an antimicrobial, an odor
3 reducing material, a binder, a fragrance, an animal health indicating material, a
4 color altering agent, a dust reducing agent, a nonstick release agent, a
5 superabsorbent material, cyclodextrin, zeolite, activated carbon, a pH altering
6 agent, a salt forming material, a transition metal salt, and mixtures thereof.
- 1 27. An animal litter as recited in claim 21, further comprising a color altering agent
2 selected from a group consisting of dye, pigment, bleach, lightener, non-staining
3 coloring agent, embedded coloring agent, and mixtures thereof.

- 1 28. An animal litter as recited in claim 21, wherein the activated alumina is present in
2 an amount of about 0.1% to about 15% by weight based on a total weight of the
3 composition.
- 1 29. An animal litter as recited in claim 21, wherein the activated alumina is present in
2 an amount of less than about 5% by weight based on a total weight of the
3 composition.
- 1 30. An animal litter as recited in claim 21, wherein a particle size of the activated
2 alumina is selected based on a particle size and density of the absorbent material
3 such that segregation of the activated alumina in the composition is minimized.
- 1 31. An animal litter as recited in claim 21, wherein colorant is added to the particles
2 of activated alumina.
- 1 32. An animal litter as recited in claim 21, wherein activated alumina is coated onto
2 the particles of absorbent material.
- 1 33. An animal litter as recited in claim 21, wherein particles of activated alumina and
2 absorbent material are combined in composite particles.
- 1 34. An animal litter as recited in claim 21, further comprising particles of a material
2 selected from a group consisting of zeolite and silica gel.
- 1 35. An animal litter as recited in claim 21, further comprising baking soda for
2 reducing sticking of the composition to a container upon wetting.
- 1 36. An animal litter as recited in claim 21, wherein the composition is flushable.

- 1 37. An absorbent composition, comprising:
2 0 to about 50% of at least one additive; and
3 up to 100% activated alumina by weight based on a total weight of the
4 composition.
- 1 38. An absorbent composition as recited in claim 37, wherein the additive is selected
2 from a group consisting of: an antimicrobial, an odor reducing material, a binder,
3 a fragrance, an animal health indicating material, a color altering agent, a dust
4 reducing agent, a nonstick release agent, a superabsorbent material, cyclodextrin,
5 zeolite, activated carbon, a pH altering agent, a salt forming material, a transition
6 metal salt, and mixtures thereof.
- 1 39. An absorbent composition as recited in claim 37, wherein the particles of
2 activated alumina have a particle size in a range from about 0.05 to about 10,000
3 microns.
- 1 40. A composite particle, comprising:
2 an absorbent material formed into a particle; and
3 activated alumina added to the absorbent material.
- 1 41. A composite particle as recited in claim 40, wherein the absorbent material is a
2 liquid-absorbing material and is selected from a group consisting of: a mineral, fly
3 ash, absorbing pelletized material, perlite, silica, organic materials, and mixtures
4 thereof.
- 1 42. A composite particle as recited in claim 40, wherein the absorbent material is a
2 mineral selected from a group consisting of: bentonite, zeolite, montmorillonite,
3 diatomaceous earth, opaline silica, Georgia White clay, sepiolite, calcite,
4 dolomite, slate, pumice, tobermite, marls, attapulgite, kaolinite, halloysite,

- 5 smectite, vermiculite, hectorite, Fuller's earth, fossilized plant materials,
6 expanded perlite, gypsum, and mixtures thereof.
- 1 43. A composite particle as recited in claim 40, wherein the absorbent material
2 comprises sodium bentonite granules having a mean particle diameter of about
3 5000 microns or less.
- 1 44. A composite particle as recited in claim 40, wherein the absorbent material
2 comprises sodium bentonite granules having a mean particle diameter of about
3 3000 microns or less.
- 1 45. A composite particle as recited in claim 40, wherein the absorbent material
2 comprises sodium bentonite granules having a mean particle diameter in the range
3 of about 25 to about 150 microns.
- 1 46. A composite particle as recited in claim 40, further comprising a performance-
2 enhancing active includes at least one of an antimicrobial, an odor reducing
3 material, a binder, a fragrance, a health indicating material, a color altering agent,
4 a dust reducing agent, a nonstick release agent, a superabsorbent material,
5 cyclodextrin, zeolite, activated carbon, a pH altering agent, a salt forming
6 material, a transition metal salt and mixtures thereof.
- 1 47. A composite particle as recited in claim 40, further comprising a color altering
2 agent selected from a group consisting of dye, pigment, bleach, lightener, non-
3 staining coloring agent, embedded coloring agent, and mixtures thereof.
- 1 48. A composite particle as recited in claim 40, wherein the activated alumina is
2 added in an amount sufficient to lighten an overall color of the composite particle

- 3 as compared to a particle containing identical materials except the activated
4 alumina.
- 1 49. A composite particle as recited in claim 40, wherein the activated alumina is
2 sprayed onto the particles.
- 1 50. A composite particle as recited in claim 40, wherein granules of activated alumina
2 are dry-blended with the particles.
- 1 51. A composite particle as recited in claim 40, wherein the activated alumina is
2 present in an effective amount to control odors.
- 1 52. A composite particle as recited in claim 40, wherein the activated alumina is
2 present in about 5 weight percent or less based on a weight of the composite
3 particle.
- 1 53. A composite particle as recited in claim 40, wherein the activated alumina is
2 present in about 1 weight percent or less based on a weight of the composite
3 particle.
- 1 54. A composite particle as recited in claim 40, wherein the activated alumina has a
2 mean particle diameter of about 5000 microns or less.
- 1 55. A composite particle as recited in claim 40, wherein the activated alumina has a
2 mean particle diameter of about 1500 microns or less.
- 1 56. A composite particle as recited in claim 55, wherein the activated alumina has a
2 mean particle diameter of about 50 microns or less.

- 1 57. A composite particle as recited in claim 40, wherein the activated alumina is
2 substantially homogeneously dispersed throughout at least a portion of the
3 absorbent particle.
- 1 58. A composite particle as recited in claim 40, wherein the activated alumina is
2 physically dispersed in at least one layer.
- 1 59. A composite particle as recited in claim 40, wherein the activated alumina is
2 physically dispersed in pockets in the particle.
- 1 60. A composite particle as recited in claim 40, wherein the activated alumina is
2 physically dispersed in at least one position selected from along surfaces of the
3 particle and contained within pores of the particle.
- 1 61. A composite particle as recited in claim 40, further comprising an absorbent core,
2 the absorbent material being coupled to the core.
- 1 62. A composite particle as recited in claim 40, further comprising a non-absorbent
2 core, the absorbent material being coupled to the core.
- 1 63. A composite particle as recited in claim 40, further comprising a hollow core, the
2 absorbent material being coupled to the core.
- 1 64. A composite particle as recited in claim 40, further comprising a core, the
2 absorbent material at least partially surrounding the core in the form of a shell,
3 wherein an average thickness of the shell is at least about four times an average
4 diameter of the core.

- 1 65. A composite particle as recited in claim 40, further comprising a core, the
2 absorbent material at least partially surrounding the core in the form of a shell,
3 wherein an average thickness of the shell is between about 1 and about 4 times an
4 average diameter of the core.
- 1 66. A composite particle as recited in claim 40, further comprising a core, the
2 absorbent material at least partially surrounding the core in the form of a shell,
3 wherein an average thickness of the shell is less than an average diameter of the
4 core.
- 1 67. A composite particle as recited in claim 40, further comprising a core, the
2 absorbent material at least partially surrounding the core in the form of a shell,
3 wherein an average thickness of the shell is less than about one-half an average
4 diameter of the core.
- 1 68. A composite particle as recited in claim 40, further comprising a heavy core
2 comprised of a material having a density higher than a density of the absorbent
3 material, the absorbent material being coupled to the core.
- 1 69. A composite particle as recited in claim 40, further comprising a lightweight core
2 comprised of a material having a density lower than a density of the absorbent
3 material, the absorbent material being coupled to the core.
- 1 70. A composite particle as recited in claim 40, further comprising a core comprised
2 of a pH-altering material, the absorbent material being coupled to the core.
- 1 71. A composite particle as recited in claim 40, wherein the particle has a bulk density
2 of less than about 90% of a bulk density of a generally solid particle containing
3 the absorbent material alone.

- 1 72. A composite particle as recited in claim 40, wherein the particle has a bulk density
2 of less than about 70% of a bulk density of a generally solid particle containing
3 the absorbent material alone.
- 1 73. A composite particle as recited in claim 40, wherein the particle has a bulk density
2 of less than about 50% of a bulk density of a generally solid particle containing
3 the absorbent material alone.
- 1 74. A composite particle as recited in claim 40, further comprising multiple cores, the
2 absorbent material being coupled to the cores.
- 1 75. A composite particle as recited in claim 40, wherein the composite particle has a
2 hydraulic conductivity value of about 0.25 cm/s or less.
- 1 76. A composite particle as recited in claim 40, wherein the composite particle
2 exhibits reduced sticking to a container in which the composite particle rests when
3 the particle is wetted relative to a generally solid particle under substantially
4 similar conditions.
- 1 77. A composite particle as recited in claim 40, wherein the composite particle has a
2 moisture content of less than about 25% by weight based on a weight of the
3 composite particle.
- 1 78. A composite particle as recited in claim 40, wherein the composite particle has a
2 moisture content of less than about 15% by weight based on a weight of the
3 composite particle.

- 1 79. A composite particle as recited in claim 40, wherein the composite particle has a
2 moisture content of less than about 10% by weight based on a weight of the
3 composite particle.
- 1 80. A composite particle as recited in claim 40, wherein the composite particle is
2 capable of absorbing a weight of water equaling at least about 90 percent of a
3 weight of the composite particle.
- 1 81. A composite particle as recited in claim 40, wherein the composite particle is
2 capable of absorbing a weight of water equaling at least about 75 percent of a
3 weight of the composite particle.
- 1 82. A composite particle as recited in claim 40, wherein the composite particle is
2 capable of absorbing a weight of water equaling at least about 50 percent of a
3 weight of the composite particle.
- 1 83. A composite particle as recited in claim 40, wherein the composite particle has a
2 dusting attrition value of at most about 15% as measured by ASTM method E-728
3 Standard Test Method for Resistance to Attrition of Granular Carriers and
4 Granular Pesticides.
- 1 84. A composite particle as recited in claim 40, wherein the composite particle
2 exhibits noticeably less odor after four days from contamination with animal
3 waste as compared to a generally solid particle of the absorbent material alone
4 under substantially similar conditions.
- 1 85. A composite particle as recited in claim 40, wherein the composite particle has
2 been formed by an agglomeration process.

- 1 86. A composite particle as recited in claim 85, wherein the agglomeration process is
2 a pan agglomeration process.
- 1 87. A composite particle as recited in claim 85, wherein the agglomeration process is
2 at least one of a high shear agglomeration process, a low shear agglomeration
3 process, a high pressure agglomeration process, a low pressure agglomeration
4 process, a rotary drum agglomeration process, a fluid bed agglomeration process,
5 a mix muller process, a roll press compaction process, a pin mixer process, a
6 batch tumble blending mixer process, an extrusion process and a fluid bed
7 process.
- 1 88. A composite particle as recited in claim 40, wherein the composite particle has a
2 bulk density of about 1.5 grams per cubic centimeter or less.
- 1 89. A composite particle as recited in claim 40, wherein the composite particle has a
2 bulk density of 0.85 grams per cubic centimeter or less.
- 1 90. A composite particle as recited in claim 89, wherein the composite particle has a
2 bulk density of between about 0.25 and 0.85 grams per cubic centimeter.
- 1 91. A composite particle as recited in claim 40, wherein the particle has a liquid
2 absorbing capability of from about 0.6 to about 2.5 liters of water per kilogram of
3 particles.
- 1 92. A composite particle as recited in claim 40, wherein the particle is used in at least
2 one of an animal litter product, a laundry product, a home care product, a water
3 filtration product, an air filtration product, a fertilizer product, an iron ore
4 pelletizing product, a pharmaceutical product, an agricultural product, a waste and
5 landfill remediation product, a bioremediation product, and an insecticide product.

- 1 93. A composite particle as recited in claim 40, wherein substantially each particle
2 includes activated alumina.
- 1 94. A composite particle as recited in claim 40, wherein substantially each particle
2 includes activated alumina and at least one other additive.
- 1 95. Multiple composite particles as recited in claim 40, wherein some of the particles
2 include a first active, and other particles contain a second active, the second active
3 being different than the first active.
- 1 96. Multiple composite particles as recited in claim 40, wherein at least about 80% of
2 the particles are retained in a clump upon addition of an aqueous solution.
- 1 97. Multiple composite particles as recited in claim 40, wherein at least about 90% of
2 the particles are retained in a clump upon addition of an aqueous solution.
- 1 98. Multiple composite particles as recited in claim 40, wherein at least about 95% of
2 the particles are retained in a clump after 6 hours upon addition of 10 ml of cat
3 urine.
- 1 99. A litterbox with an absorbent composition disposed therein, comprising:
2 a receptacle with a closed bottom and a plurality of interconnected generally
3 upright side walls forming an open top;
4 particles of an absorbent material disposed in the receptacle; and
5 particles of activated alumina disposed in the receptacle.
- 1 100. An absorbent composition, comprising:
2 0 to about 50% of at least one additive; and

3 to 100% of an aluminum-containing material by weight based on a total weight of
4 the composition, wherein the aluminum containing material is derived
5 from at least one of gibbsite, boemite, pseudo boemite, and bauxite.

1 101. An absorbent composition, comprising:
2 particles of an absorbent material; and
3 secondary particles selected from a group consisting of activated alumina and
4 zeolite, the secondary particles being dry mixed with the particles of
5 absorbent material, the secondary particles being present in an amount of
6 about 0.01% to about 50% by weight based on a total weight of the
7 composition.

1 102. An absorbent composition as recited in claim 1, wherein the absorbent material is
2 selected from a group consisting of: a mineral, fly ash, absorbing pelletized
3 material, perlite, silica, organic materials, and mixtures thereof.

1 103. An absorbent composition as recited in claim 1, wherein the absorbent material is
2 a mineral selected from a group consisting of: bentonite, zeolite, montmorillonite,
3 diatomaceous earth, opaline silica, Georgia White clay, sepiolite, calcite,
4 dolomite, slate, pumice, tobermite, marls, attapulgite, kaolinite, halloysite,
5 smectite, vermiculite, hectorite, Fuller's earth, fossilized plant materials,
6 expanded perlite, gypsum, and mixtures thereof.

1 104. An absorbent composition as recited in claim 1, further comprising a color
2 altering agent applied to the at least one of the activated alumina and the zeolite,
3 the color altering agent being selected from a group consisting of dye, pigment,
4 bleach, lightener, non-staining coloring agent, embedded coloring agent, and
5 mixtures thereof.

- 6 105. An absorbent composition, comprising:
7 particles of an absorbent material; and
8 colored particles mixed with the particles of absorbent material, the colored
9 particles with a bulk density of about from 50% to 150% that of the absorbent
10 material.
11
- 12 106. An absorbent composition as recited in claim 105 wherein the bulk density of the
13 colored material is about from 70% to 130% that of the absorbent material.
14
- 15 107. An absorbent composition as recited in claim 105 wherein the bulk density of the
16 colored material is about from 90% to 110% that of the absorbent material.
17
- 18 108. An absorbent composition as recited in claim 105 wherein the bulk density of the
19 colored material is about equivalent to that of the absorbent material.
20
- 21 109. An absorbent composition as recited in claim 105 wherein the colored material is
22 zeolite.
23
- 24 110. An absorbent composition as recited in claim 105, wherein the absorbent material
25 is a mineral selected from a group consisting of: bentonite, montmorillonite,
26 diatomaceous earth, opaline silica, Georgia White clay, sepiolite, calcite,
27 dolomite, slate, pumice, tobermite, marls, attapulgite, kaolinite, halloysite,
28 smectite, vermiculite, hectorite, Fuller's earth, fossilized plant materials,
29 expanded perlite, gypsum, and mixtures thereof.
30
- 31 111. An absorbent composition as recited in claim 105, wherein a color altering agent
32 is used to make the colored particle, the color altering agent being selected from a
33 group consisting of dye, pigment, bleach, lightener, non-staining coloring agent,
34 embedded coloring agent, and mixtures thereof.

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36 112. An absorbent composition as recited in claim 105, wherein the absorbent
37 composition is an animal litter

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39 113. A composite particle, comprising:
40 an absorbent material formed into a particle; and
41 zeolite added to the absorbent material.

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